A COMPARATIVE STUDY BETWEEN THREE IN ONE FEMORAL NERVE BLOCK AND PSOAS COMPARTMENT BLOCK FOR POST OPERATIVE ANALGESIA IN ORTHOPAEDIC PROCEDURES ON FEMUR

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ANAESTHESIOLOGY

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CONTENTS

INTRODUCTION

Peripheral nerve blocks can be used for doing surgeries or for post operative analgesia, depending upon the concentration of local anaesthetics used, if the surgery is to be performed involving the limbs. If it is a long (or) major procedure and requiring abnormal positioning, sole peripheral nerve block will be uncomfortable for the patient. If the procedure involves larger bones, like femur, which mostly requires lateral position, and duration is longer, it is always better to do it under general anaesthesia or spinal anaesthesia. As the volume of drug which is needed for these procedure is very high if it is done solely under peripheral nerve blocks, it may cause toxicity of local anaesthetics. But peripheral nerve blocks of lower concentration, combined with general anaesthesia (or) sub arachnoid block will not cause toxicity, but provide a very good post operative analgesia.

Major limb surgery is often painful and requires aggressive management. Post operative pain relief can be achieved by a variety of techniques including parental NSAIDS, epidural analgesia, patient controlled analgesia, IV analgesia with opioids.

Peripheral nerve blocks are suitable substitutes for parenteral analgesics for post operative analgesia in lower limb surgery.

The inguinal perivascular technique of lumbar plexus commonly known as ‘3 in 1’ block has been shown to provide effective analgesia following hip

and knee surgeries and surgeries on femur. Few investigators have questioned its efficacy due to incomplete block of obturator nerve, since it is mainly a motor nerve and gives some sensory branches. Failure to achieve block of this nerve may cause incomplete analgesia after hip surgery.

An alternative technique for lumbar plexus analgesia is psoas compartment block. The present study was done to compare the efficacy of “3 in 1” versus psoas compartmental block in relieving post operative pain for orthopaedic procedures in femur.

AIM OF THE STUDY

To evaluate the efficacy and duration of post operative analgesia for orthopedic procedures of femur using

- Three in one nerve block versus psoas compartment block with 0.25% bupivacaine.

The following parameters are compared

1. Time taken for performing the block
2. Time taken for the onset of block (loss of cold sensation)
3. Time from the end of surgery and the onset of severe pain requiring analgesics (Duration of post operative analgesia).

APPLIED PHYSIOLOGY

Physiology of Nerve conduction[38]

All peripheral nerves are elongated axons of neurons situated centrally. A typical peripheral nerve consists of bundles of motor, sensory and other fibres enclosed in the outermost covering called epineurium. Inside the epineurium the perineurium surrounds the collection of bundles. Each bundle is surrounded by an endoneurium. Each nerve fibre in a bundle is enclosed in a layer of neurilemma or the axonal membrane.

Depending on the presence or absence of myelin sheath, it can be a myelinated nerve fibre or unmyelinated nerve fibre.

The axonal membrane itself is made up of a bimolecular lipid palisade, interspersed with large protein molecules. The membrane lipids are largely phospholipid composed of a polar head group and a nonpolar hydrocarbon tail.

The primary function of the cell membrane is to separate the extracellular from the intracellular environment. The major difference between these two environments is the ionic concentration. This disequilibrium provides the means for impulse conduction.

The most important ions in this respect are sodium and potassium. A membrane bound Protein $Na^{+}K^{+}$ ATPase maintains normal resting equilibrium potential between -50 MV to -90MV by pumping sodium ions out of the cell and potassium ions in to the cell. A positive ion gradient from inside the membrane to the outside causes electronegativity inside the membrane.

During nerve conduction the following changes occur in the cell membrane.

In the resting phase

There is a potential difference across the membrane, inside the cell is negative, due to a higher concentration of sodium ions outside the cell than inside the cell. The cell membrane is relatively impermeable to the sodium ions whose gradient is maintained by the sodium pump which is an active process.

Depolarization phase

During excitation, sodium channels in the cell membrane open briefly allowing sodium ions to flow into the cell, thereby depolarizing the membrane.

Neutralisation Phase

During this phase, potassium ions passout of the cell to restore electrical neutrality.

Restoration phase

During this phase, sodium ions return outside the cell and potassium ions reenter the cell.

In the myelinated fibre, this depolarization occurs only at the nodes of Ranvier thus giving rise to saltatory conduction of the nerve impulse thus enabling depolarization to spread rapidly.

The sodium channel is believed to be an integral membrane spanning protein. The three dimensional configuration of the protein forms a pore through the neuronal membrane.

Depolarization of the cell induces a configurational change on the sodium channel which causes it to open and allow ion passage.

Action of Local anaesthetic

The primary action produced is electrical stabilization. The large transient increase in permeability to sodium ions necessary for propagation of the impulse is prevented by local anaesthetic agents. Thus the resting membrane potential is maintained and depolarization in response to stimulation is inhibited.

Local anaesthetics block sodium conductance probably by dual action on the cell membrane.

1. **Membrane stabilization theory** : They act directly on receptors within the sodium channels. They act probably by binding to the subunits of the sodium channel protein thereby inhibiting the conformational change in the protein during cellular depolarization.
2. **Membrane expansion theory :** They produce nonspecific membrane expansion. There is an unfolding of membrane protein together with a disordering of the lipid component of the cell membrane with consequent obstruction of the sodium channels.

APPLIED ANATOMY[18]

Lower limb is innervated by two major nerve plexuses namely

1. Lumbar plexus
2. Lumbosacral plexus

LUMBAR PLEXUS

Supplies Anterior, Medial and Lateral aspect of thigh, hip joint, knee joint, and anteromedial portion of leg.

LUMBOSACRAL PLEXUS

Supplies posterior part of thigh, knee joint, lateral and posterior portions of leg and whole of foot.

LUMBAR PLEXUS

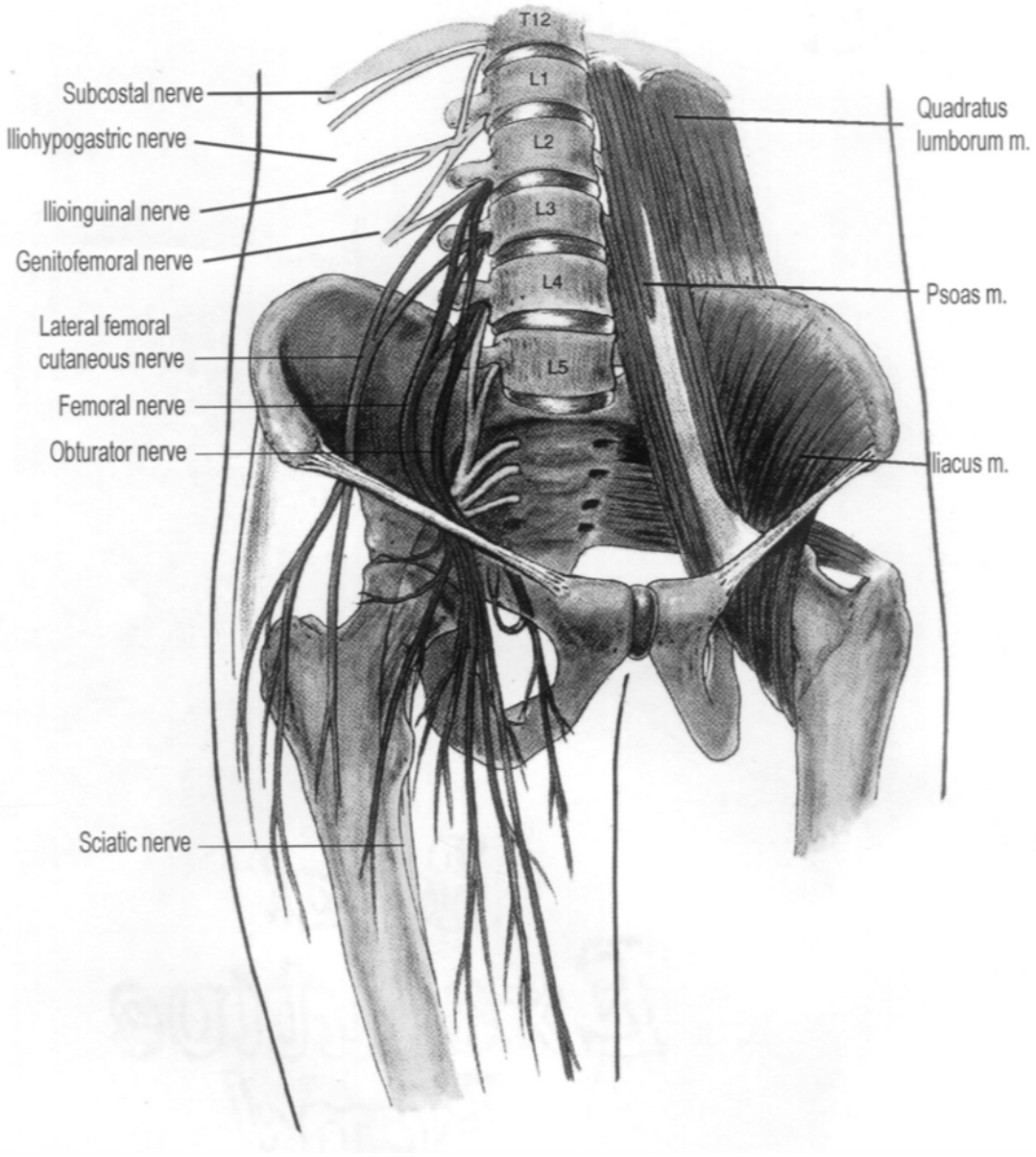
Formation

The Lumbar plexus is derived from the anterior primary rami of 1^{st}, 2^{nd}, 3^{rd} and part of 4^{th} lumbar nerve roots. In 50% of the subjects, an additional contribution arises from T_{12}.

The plexus assembles in the substance of the psoas major muscle.

L_1 divides in to an upper and lower division. The upper division gives rise to the iliohypogastric and ilioinguinal nerves.

LUMBAR AND LUMBOSACRAL PLEXUS : FORMATION



The lower division joins a branch from L_2 to form the genito femoral nerve.

The rest of L_2 with L_3 and the contribution from L_4 divide in to dorsal and ventral division.

Dorsal divisions of L_2 and L_3 form the lateral cutaneous nerve of thigh and those of L_2, L_3 and L_4 form the femoral nerve.

The Ventral divisions of L_2, L_3 and L_4 join to form the obturator nerve.

LUMBO SACRAL PLEXUS IS FORMED BY:

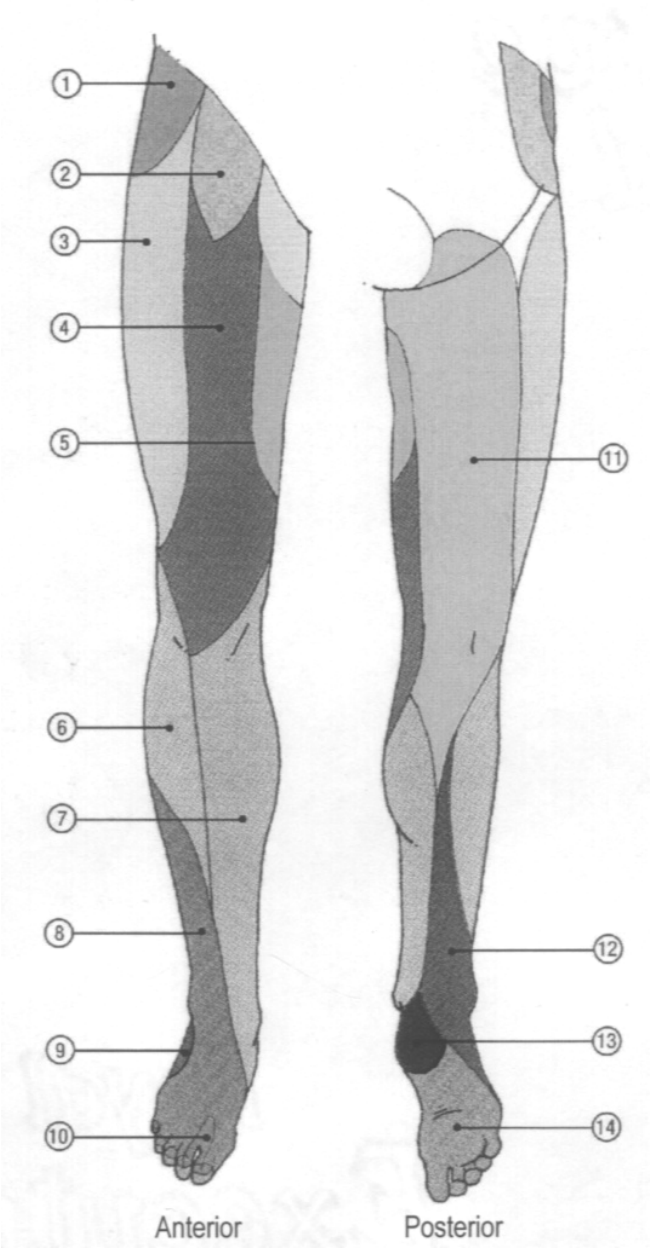
a. Ventral rami of L_4 and L_5.

b. Ventral rami of S_1, S_2, S_3 and S_4.

Lumbosacral trunk form the sciatic nerve. The sciatic nerve is composed of tibial nerve and common peroneal nerve. Usually the sciatic nerve splits into these two components at the apex of popliteal fossa, but the division may occur at any level proximally. The junction of S3 and portion of S4, is prolonged into the pudendal nerve.

Branches include muscular, cutaneous and visceral collateral and terminal, the sciatic and pudendal.

CUTANEOUS INNERVATION OF THE LOWER LIMB



1. Lateral cutaneous branch of subcostal nerve
2. Femoral branch of genitofemoral nerve
3. Lateral femoral cutaneous nerve
4. Anterior femoral cutaneous nerve
5. Obturator nerve
6. Common peroneal nerve
7. Saphenous nerve
8. Superficial peroneal nerve
9. Sural nerve
10. Deep peroneal nerve
11. Posterior cutaneous nerve of thigh
12. Sural nerve
13. Calcaneal branch of tibial nerve
14. Plantar branches of tibial nerve

Cutaneous distribution of lower limb nerves

Cutaneous distribution of the lower limb nerves show considerable variation. There is a large degree of overlapping between adjacent territories.

Innervation of deep structures

It is generally assumed that muscles and bones are supplied by the same nerves as the skin overlying them.

Joints have a more complex nerve supply and receive innervation from all the nerves supplying structures around them. eg. Hip and knee joints are supplied by femoral, sciatic and obturator nerves. Ankle joint is supplied by femoral and sciatic nerves.

Course and Distribution of Nerves of Lower Limb

After formation, the branches of the lumbar plexus lie in the fascial plane between the psoas major muscle anteriorly and the iliacus muscle posteriorly forming the bed.

Femoral nerve is the largest nerve of the lumbar plexus and, in brief, supplies the muscles and the skin of the anterior compartment of the thigh. The nerve emerges from the lateral margin of psoas, passes downwards in the groove between psoas and iliacus (to both of which it sends a nerve supply), then enters the thigh beneath the inguinal ligament. At the base of the femoral triangle the nerve lies on iliacus, a finger breadth lateral to the femoral artery. Once within the triangle the nerve breaks up in to its terminal branches which stem from an anterior and posterior division.

Anterior division

Muscular branches to:

1. Pectineus
2. Sartorius.

Cutaneous Branches:

1. Intermediate cutaneous nerve of thigh;
2. Medial cutaneous nerve of thigh.

Posterior Division

Muscular branches to quadriceps femoris

Cutaneous branch - saphenous nerve

Articular branches to:

1. hip;
2. knee.

Obturator nerve emerges from the medial border of the psoas at the pelvic brim and crosses downward and forward in to the obturator canal. Within the canal it branches into anterior and posterior division and supplies medial aspect of thigh.

Lateral cutaneous nerve of the thigh (L2, 3) emerges from the lateral border of the psoas immediately inferior to the ilio-inguinal nerve. Passing over

iliacus, the nerve enters the thigh by running below the lateral extremity of the inguinal ligament and divides into an anterior and a posterior branch. The anterior branch supplies the skin over the antero lateral aspect of the thigh down to the knee. The posterior branch penetrates the fascia lata to innervate the skin of the lateral aspect of the leg from the greater trochanter to the mid - thigh.

TECHNIQUES OF LUMBAR PLEXUS BLOCK [8,28]

1. Anterior approach

2. Posterior approach

I. Anterior Approach (3 in 1 Nerve Block)

Blockade of lumbar plexus provides sensory anaesthesia of the anterior thigh, knee and medial aspect of the calf, ankle and foot.

i. Nerve stimulation technique

ii. Loss of resistance technique

iii. Seeking paresthesia

The Nerve Stimulation Technique

Patients were placed in the supine position and the skin over the area to be injected was prepared with antiseptic solution. In the nerve stimulator technique, the point of needle insertion site is 1.5 cm lateral and 1.5 cm distal to the intersection of the inguinal ligament and the femoral artery. The Teflon – coated nerve stimulator needle is inserted through the skin at 45 degree angle to the skin and directed cephalad and slightly medially toward the umbilicus. A motor evoked response of movement of patella indicates stimulation of femoral nerve. After negative aspiration for blood 30-40ml of Local anaesthetic is injected with distal pressure to aid proximal spread of local anaesthetic.

Loss of Resistance Technique

The femoral artery is palpated below the inguinal ligament and a 50 mm needle is inserted 1.5 cm lateral and 1.5 cm distal to the intersection of the inguinal ligament and the femoral artery directed 45^{o} cephalad. Two distinct 'pops' or 'clicks' are felt (the fascia lata and ilio-pectineal fascia) which indicated placement of the needle in the perineural space.

Seeking Paresthesia

Eliciting paresthesia provides a definite endpoint for locating the nerve, but requires an awake and responsive patient. Paresthesia elicited during axillary brachial plexus block have been associated with neural injury and this has raised concern about the use of this technique in other peripheral nerve blocks.

II. Posterior Approach

Theoretically, the simplest approach to the lumbosacral plexus is injection into the psoas compartment or sheath. The fascial planes of the posterior border of the psoas muscle and the anterior border of the quadratus lumborum form the envelop which encloses the nerve roots in a manner similar to the scalene muscles in the neck. This approach usually anesthetizes the lumbar branches of the plexus, but usually does not provide adequate anaesthesia of the sciatic plexus.

The Nerve Stimulation Technique

Patients were placed in the lateral decubitus position with the side to be block uppermost. The skin over the area to be injected was prepared with antiseptic solution. A line was drawn between the iliac crests. Midline at the fourth lumbar spine was marked. A second line was made five centimeters parasagitally to the midline. Point of Intersection of the two lines identify the injection site.

A 100 mm insulated needle is inserted in a horizontal plane with the needle tip directed slightly caudad, with the aim of contacting the transverse process (4-7 cm) or stimulating the lumbar plexus (quadriceps muscle twitch) (8-10 cm), whichever occurs first. When the transverse process is contacted, the needle is withdrawn and then reinserted with a slight cephalad or cauded orientation to pass above or below the transverse process. Stimulation of the lumbar plexus occurs, causing contraction of the quadriceps femoris muscle; 20-40 ml (max 0.5ml/kg) of local anaesthetic is then injected.

Loss of Resistance Technique

Positioning and preparing is the same as the nerve stimulating technique. Here the space is located by connecting an air filled syringe to the needle. The space is identified by sudden loss of resistance to inject the air which is similar to locating epidural space. False localization of space is more and so chances of patchy block or failed block is more.

PHARMACOLOGY OF LOCAL ANAESTHETICS[16]

A local anaesthetic drug is one which reversibly blocks nerve conduction beyond the point of application, when applied locally in the appropriate concentration.

Commonly used local anaesthetics are either aminoacyl or aminoalkyl amides. The amine group confers on the molecule, the property of a weakbase, which can combine with an acid to form a water soluble salt. This salt ionizes in solution and is usually stable. The base forms of the amide local anaesthetics are virtually insoluble in water. Hence local anaesthetics are prepared commercially as hydrochloride salts and these solution have a highly acidic pH.

MECHANISM OF ACTION OF LOCAL ANAESTHETICS

When solution of local anaesthetics are deposited near the nerve, diffusion of drug molecules away from the locus is a function of:

1. Tissue binding
2. Removal from the circulation
3. Local hydrolysis of aminoester anaesthetics

Only the remaining molecules penetrate the nerve sheath.

Local anaesthetic molecules permeate the nerve axon membrane and equilibrate there and in the axoplasm. The spread and extent of these processes depends on a particular drug's pKa and the lipid solubility of the base and cation species. Binding of local anaesthetic to the site of voltage gated Na^+ channels prevents the opening of channels by inhibiting conformational

changes that normally produce channel activation. Rates of onset and recovery from blockade are governed by the relatively slow diffusion of local anesthetic molecules into and out of the nerve and not by the much faster binding and dissociation to ion channels.

PHARMACODYNAMICS OF LOCAL ANAESTHETICS

Conduction blockade of a local anaesthetic is dependent on three physicochemical properties namely.

1. Lipid solubility which determines the onset of tissue penetration and potency of the drug.
2. Protein binding characteristics which determine the duration of action.
3. pKa which determines the onset time of a local anaesthetic. PKa of a drug is defined as the pH at which the drug exists 50% in the ionized form and 50% in the nonionized form. The uncharged basic form of local anesthetic is primarily responsible for diffusion across the nerve shealth, while the cationic form of the drug is responsible for the nerve blocking effect.

In general at a tissue pH of 7.4 the proportion of local anaesthetic which exists in the unionized form is inversely proportional to its pKa. Thus a drug like lignocaine with pKa of 7.74 will be 65% ionized and 35% unionized at tissue pH. On the other hand amethocaine which has a pKa of 8.6 will be 95% ionized and 5% unionized and thereby the onset of action is delayed.

PHARMACOKINETICS OF LOCAL ANAESTHETICS

Concentration of local anaesthetic in blood is determined by:

1. Rate of absorption from the site of injection.
2. Rate of distribution.
3. Rate of metabolism and excretion of the agent.

Systemic absorption of a local anaesthetic agent is determined by the site of the injection, the dosage, the addition of vasoconstrictors and the pharmacological characteristics of the agent. Eg. Lipid solubility, vasoactive properties etc.

Local anaesthetic agents are distributed throughout total body water. The distribution can be described by a 3 compartment model.

1. **Alpha phase** relates to uptake by rapidly equilibrating tissues eg. Brain and heart.
2. **Beta Phase** refers to uptake by tissues with lower perfusion e.g. Muscles and bones.
3. **Gamma Phase** is determined by the rate of metabolism and excretion of the agent.

Local Anaesthetic Toxicity

Systemic toxicity is primarily a function of plasma levels and can be altered by multiple drugs and patient factors. Toxicity usually follows intravenous injection of a large dose of local anaesthetic.

The commonly used local anaesthetics are racemic mixtures of stereoisomer. Studies with bupivacaine have shown that the ‘R’ isomer has significantly more cardiotoxicity with no increase in local anaesthetic potency and therefore its presence accounts for a significant element of the cardiovascular toxicity of bupivacaine.

Local anaesthetic systemic toxicity is primarily manifested as a derangement of the central nervous system and the cardiovascular system.

CENTRAL NERVOUS SYSTEM

Local anaesthetics can cause both excitation and depression of the CNS depending on the plasma level. Depression of inhibitory pathways in the cerebral cortex occurs at lower plasma concentrations than those required for generalized CNS depression. This allows excitatory neurons to function in an unopposed fashion initially.

Symptoms are light headedness, dizziness, oro-facial numbness, visual and auditory disturbances, disorientation and drowsiness.

Signs include shivering, muscular twitching and tremors initially involving muscles of the face and distal parts of the extremities. These may progress to generalized convulsions of a tonic - clonic nature.

Prophylaxis and Treatment of CNS toxicity

- Avoid administration of inappropriately large doses.
- Fractionation of the required bolus dose
- Early control of seizures and ventilation significantly reduces overall mortality.

Cardiovascular system toxicity

Systemic absorption of local anesthetic agents can excert direct effects on both cardiac muscle and vascular smooth muscle resulting in a broad range of effects.

1. Initial CVS stimulation stage

Hypertension

Tachycardia

2. Primary CVS depressant stage

Negative Inotropism

Decreased cardiac output

Mild - moderate hypotension

3. Secondary CVS depressant stage

Marked decrease in cardiac output

Peripheral vasodilatation

Profound hypotension

4. Terminal CVS depressant stage

Sinus bradycardia

Intracardiac conduction defects

Ventricular arrhythmias

Cardiac arrest

The aetiology of these bupivacaine induced arrhythmias is related to the prolonged inhibition of sodium conductance in the cardiac membrane. It also blocks slow calcium channels and potassium channels. Bupivacaine is 16 times as potent as lignocaine in inducing ventricular arrhythmias. Bupivacaine has been characterized as a “fast-in, slow -out” agent.

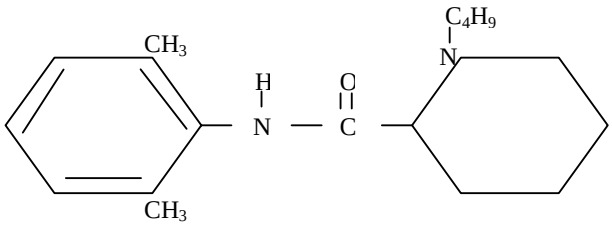
Cardiac Resuscitation

Isoprenaline 1-2 μg/min is effective in treating the bradycardia and reversing the depression of atrial and ventricular conduction caused by bupivacaine. Amrinone a phosphodiesterase inhibitor also appears to increase survival in animals treated with toxic doses of bupivacaine.

Cardiopulmonary resuscitation following collapse can be extremely difficult. Hypoxia and acidosis develop very quickly. Massive doses of cardiac stimulants and prolonged efforts at mechanical chest compression may be necessary.

PHARMACOLOGY OF BUPIVACAINE

Bupivacaine is an aminoacyl amide synthetic local analgesic, which has been synthesized at AB Bofors by AF EKENSTAM et al. (1957). Clinically used by Telivuoin in 1963 it is produced for clinical use as a racemic mixture of the enantiomer containing equal proportions of the 'S' and 'R' forms.



Bupivacine

PHYSIOCHEMICAL PROPERTIES

Bupivacaine has a butyl group on the piperidine nitrogen atom of the molecule. It is a long acting local anaesthetic drug with high anaesthetic potency. It is more lipid soluble, highly protein bound and has greater intrinsic potency. It is 3-4 times as potent as lignocaine. It crosses the placenta and the blood brain barrier.

1.	Molecular weight base	-	288
2.	pKa	-	8.1
3.	Partition coefficient	-	346
4.	Mean uptake ratio	-	3.3
5.	Protein Binding	-	96%

PHARMACOLOGICAL PROPERTIES

Onset	Moderate
Relative Potency	8
Duration	Long acting

MECHANISM OF ACTION

Bupivacaine inhibits electrical stimulation of the membrane by dual action on sodium conductance.

1. Acts directly on the receptors within the sodium channels.

2. Produces non - specific membrane expansion

PHARMACOLOGICAL EFFECTS

a. Local : Nerve Blockade

b. Regional : Pain, temperature, touch, motor power and vasomotor tone in the region supplied by the nerves are blocked.

c. Systemic : Effects occurring as a result of systemic absorption or intravenous administration.

On the cardiovascular system, the effect of bupivacaine is dose related. It depresses the automaticity of the heart and myocardial contractility. Depending on the membrane potential and the rate of stimulation, bupivacaine depresses Vmax considerably more than lignocaine and results in slowed conductance of the cardiac action potential which is manifested by prolongation of the RR and QRS intervals of the electrocardiogram. This

results in reentrant phenomena and ventricular arrhythmias. The sodium channels are blocked in a “fast-in, slow out” manner which causes difficulty in resuscitation when ventricular fibrillation has occurred. The cardiotoxicity of bupivacaine results from high lipid solubility and the R-enantiomer is more toxic than S-enantiomer.

PHARMACOKINETICS

Volume of distribution at

Steady state (Vss)	-	73 litres
Terminal elimination ½ life	-	210 minutes
Clearance	-	0.58 litres/ min
Plasma protein binding	-	96%
Metabolism	-	Liver by N-dealkylation to pipecolyloxlidine
Excretion	-	by kidney 5% as unchanged drug and rest as metabolites.

Preparations available

0.125%

0.25%

0.5%

With 0.1% methylparaben as preservative

Contraindications

1. Hypersensitivity : Very rare; but has been recorded

2. Intravenous regional anesthesia

3. High concentrations in obstetric patients

Mode of Use

Minor nerve block	:	0.25 - 0.5%
Major nerve block	:	0.25 - 0.5%
Epidural (analgesia)	:	0.125 - 0.25%
Epidural (for surgery)	:	0.5%
Spinal	:	0.5%

the maximum safe dose depends on:

1. Route of administration

2. Addition of vasoconstrictor

Recommended dose	:	2-3mg/kg
		3-4 mg/kg with adrenaline.

The addition of epinephrine will decrease plasma levels of bupivacaine in lower extremity blocks.

REVIEW OF LITERATURE

Until recently orthopedic surgery patient relied mostly on traditional analgesic methods, such as narcotic administration by injection or by mouth. It requires doses of medication large enough to bring about the possibility of unwanted effects including respiratory depression, sedation and constipation. Plexus anaesthesia such as psoas sheath and three in one blocks, is used pre-emptively in lower extremity orthopedic surgery, where satisfactory pain relief is difficult to ensure. Plexus anaesthesia is well established and commonly performed for surgeries of the upper extremity but has not been performed as frequently for lower limb procedures.

Winnie AP, Ramamurthy and Durrani Z (1973)[38], described the inguinal perivasular techniques of lumbar plexus anaesthesia. They documented the blockade of femoral nerve, lateral cutaneous nerve of thigh and obturator nerve with a single injection of 20 ml of local anaesthetic into the femoral sheath and this came to be known as the 3-in1 block.

Chayen,. Nathan and Chayen (1976)[9] described a posterior approach to lumbar plexus, by injection of psoas compartment at the L_4 level. This approach was developed on the basis that the lumbar plexus nerves and some of the sacral plexus nerves are found in close proximity to each other at this level and lie within the substance of psoas muscle. The Chayen et al technique involved identifying 4^{th} lumbar vertebra and inserting the needle three centimeters cauded and five centimeters laterally to the midline until the needle

encountered the transverse process of fifth lumbar vertebra. The needle was then redirected cephalad until it passed over the top of the transverse process and advanced two centimeters further, which placed the needle in the quadratus lumborum. A loss of resistance technique was then used to advance the needle into the psoas compartment. Chayen et al, suggested the parathesia may occur, but were not necessary for successful blockade.

Patel, Flashburg, paskin and Grossman (1986)[31] compared 3 in 1 block versus general anaesthesia in knee arthroscopy and concluded that 3 in 1 provides effective pain relief and decreased incidence of nausea and vomiting.

Parkinson et al (1989)[29] compared different techniques of blocking lumbar plexus in lower extremity surgeries and the effectiveness in blocking the lumbar plexus.

Anker – Moller E, Dahl JB et al (1990)[2] performed inguinal perivascular block (3 in 1 block). The three main nerves from the lumbar plexus may be blocked by injection of local anaesthetic into the fascial envelop of the femoral nerve (3 in 1 block). The femoral nerve may be localized by obtaining parathesia, by employing a nerve stimulator or by the loss of resistance technique. They preferred use of a nerve stimulator. “3 in 1 block” may be employed for immediate pain relief and for treatment of post operative pain from fractures of the hip, femur and knee.

Ben – David, lee and Croitoru (1990)[4] compared the effectiveness of psoas sheath and three in one blocks for post operative analgesia in hip surgeries.

Narisour and Bennett (1996)[25] demonstrated the effectiveness of combined continuous lumbar plexus block and single shot sciatic block for post operative analgesia in anterior cruciate ligament reconstruction and total knee replacement surgery. They suggested the lumbar plexus block alone is inadequate in providing analgesia after major knee surgery because of the innervation to the joint supplied by the sciatic nerve.

Jankowski CJ, Girsch et al (1997)[21] compared femoral 3 in 1 block with spinal, epidural and general anaesthesia in out patients undergoing knee arthroscpy. They found that 3 in 1 block patients had shortened hospital stay, decreased nausea and vomiting and improved post operative analgesia.

Allen JG, Denny NM et al., (1998)[1] carried out a study comparing spinal anaesthesia and combined sciatic femoral 3 in 1 block for post operative analgesia following total knee arthroplasty. 39 patients studied were randomly assigned to receive either sub – arachnoid block (n-19) (or) sciatic femoral block (n-20) visual analog pain score and morphine requirements were recorded for 48 hrs following surgery. They observed that in comparison with spinal anaesthesia, sciatic femoral block resulted in superior analgesia and reduced morphine consumption for first 24 hrs following total knee arthroplasty.

Captain Cheryl A. Burch (Oct 1999)[13] post operative analgesia using psoas sheath block versus three in one block in anterior cruciate ligament reconstruction. Regional techniques were grouped into Group A- psoas

compartmental block – which gives 80% of blockade of all 3 nerves. Group B – 3 in 1 nerve block which gives blockade of all 3 nerves in 50% of cases.

Marohofer P et al (2000)[26] evaluated the sensory onset time and quality of sensory block of ropivacaine for 3 in 1 block. The sensory onset time and the quality of sensory block assessed by pinprick test in the central sensory region of each of the 3 nerves. They found no significant difference in sensory onset time between two groups.

Huey Ping NG MD, keng FaH Cheong MD, Aymeric Lim MD, Jai Lim MD, Mark E, Puhaidran MD (May 2001)[16] compared intraoperative 3 in 1 femoral nerve block with ropivacaine 0.25%, ropivacaine 0.5% or bupivacaine 0.25% provides comparable 48 hr analgesia after unilateral total knee replacement and concluded that "3 in 1" FNB with ropivacaine provided analgesia that was clinically comparable to that of bupivacaine upto 48 hrs after TKR.

R Fournier, E VanGessel, G Gaggero, A Boccovi, A Forster and Z Gamulin (Anas Analg 2002)[17] studied the effectiveness of 3 in 1 femoral nerve block for post operative analgesia after prosthetic hip surgery and concluded there is a short term benefit during the first few post operative hours in using a single shot '3 in 1' femoral nerve block to complement general anesthesia for elective hip surgery.

Xavier Capdevilla et al (2002)[40] continuous three in one block for post – op pain after lower limb orthopedic surgery. Where do the catheters go.

This study demonstrates that the course of the catheter was totally unpredictable during insertion for continuous three in one block. only 23% of catheters were in the ideal location.

Ismail Kaloul MD et al., (2002 Oct)[20] The posterior lumbar plexus block and three in one femoral nerve block provide similar post operative analgesia after total knee replacement, they concluded that both continuous Psoas block and continuous three in one nerve block provided better analgesia than PCA but no differences were seen between the two regional techniques.

MATERIALS AND METHODS

This study was carried out in Orthopaedic Theatre, Government Stanley Hospital, Chennai after obtaining Hospital ethical committee approval. The aim of the study was to compare the duration of post operative analgesia after orthopaedic procedure of femur using lumbar plexus block versus three in one nerve block and also to compare the time taken for the onset of block, using nerve locator.

Selection of cases

50 patients belonging to ASA I & II who were to undergo elective orthopaedic procedure on the femur where chosen. All the patients were assessed and those with normal clinical and biochemical radiological and hematological parameters were selected. Informed written consent was obtained from all the patients.

STUDY DESIGN

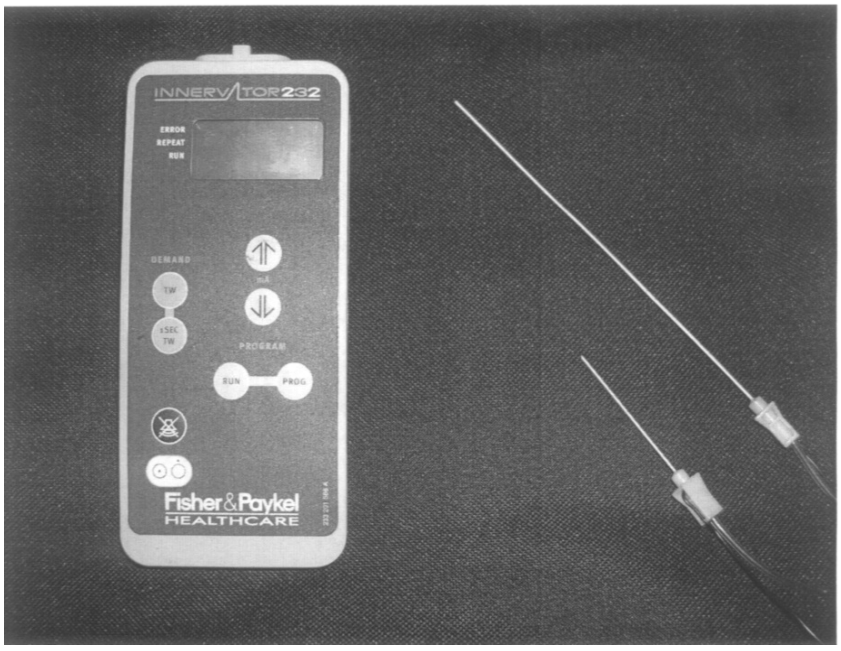
The study was done in a randomized fashion, patient were allocated to one of the two groups.

Group I : Three in one nerve block

Group II : Psoas compartmental block

BUPIVACAINE

NERVE LOCATOR & NERVE LOCATOR NEEDLES



Group I : Received 0.25% bupivacaine 0.5ml / kg limited to 30 ml max – for 3 in 1 nerve block

Group II : Received 0.25% bupivacaine 0.5ml / kg limited to 30 ml max. for Psoas compartmental block

Inclusion criteria :

1. Patient of physical status ASA I and II
2. Normal biochemical and hematological parameters
3. BMI < 30

Exclusion criteria

1. History of allergy to local anaesthetics
2. Bleeding diathesis
3. Neurological disorders
4. Local sepsis
5. Patient refusal
6. Technical failure

Materials

Materials include IV set up for infusion and resustication equipments including.

Equipments

Intubation set

Masks, Airways, Endotracheal tubes

Ventilation (oxygenation equipments)

Drugs

Local Anaesthetics : 0.25% Bupivacaine

Adrenaline

Hydrocortisone

Vasopressor : Ephedrine

Atropine, sedative (midazolam)

Thiopentone sodium

Succinyl choline

Accessories :

Antiseptic solution, sterile gloves.

Patch electrode, marker pen

Nerve locator (Fischer & Paykel) capable of delivering single twitch at 1 Hz with a current strength between 0.2 to 5.0 mA. Blunt tipped insulated nerve locator needle (Braun) with extension tubing for drug administration.

Methods

Preoperative Preparation :

Patients were assessed preoperatively. Procedure was explained to the patient and written informed consent was obtained. They were assessed with particular attention for any contraindication and exact weight was recorded.

Over night fasting was advised.

Assessment of pain using modified 4 point verbal rating scale (Cheong et al 2001)[14] was explained to the patient pre-operatively.

Pain Score

0 - No Pain
1 - Mild Pain
2 - Moderate Pain
3 - Severe & Intolerable Pain

Premedication

All patient were premedicated with Tab.Diazepam 10mg the previous night.

Conduct of anaesthesia

On arrival of the patient in the operating room, ECG, Pulse oximetry and blood pressure base line values were recorded. After explaining the procedure to the patient an intravenous access was obtained in the dorsum of

the hand and intravenous infusion of Ringer lactate was started. Injection midazolam 0.05mg / kg and Inj. Fentanyl 1µg/kg glycopyrolate. 0.05mg/ kg were given to all the patients. Then they were given either 3 in 1 block (or) psoas compartmental block.

Three-In-One Nerve Block

Lumbar plexus lie in the fascial plane between the illacus and the psoas muscle The concept of the three-in-one block is to inject local anesthetic which should follow the fascial plane to the nerve roots (Brown, 1992)[5]

Positioning

Patient was positioned supine with 15^{o} abduction of thigh on a flat surface. The inguinal region and thigh was thoroughly cleaned with Povidone iodine solution and sterile drapes were placed around the site.

Landmarks

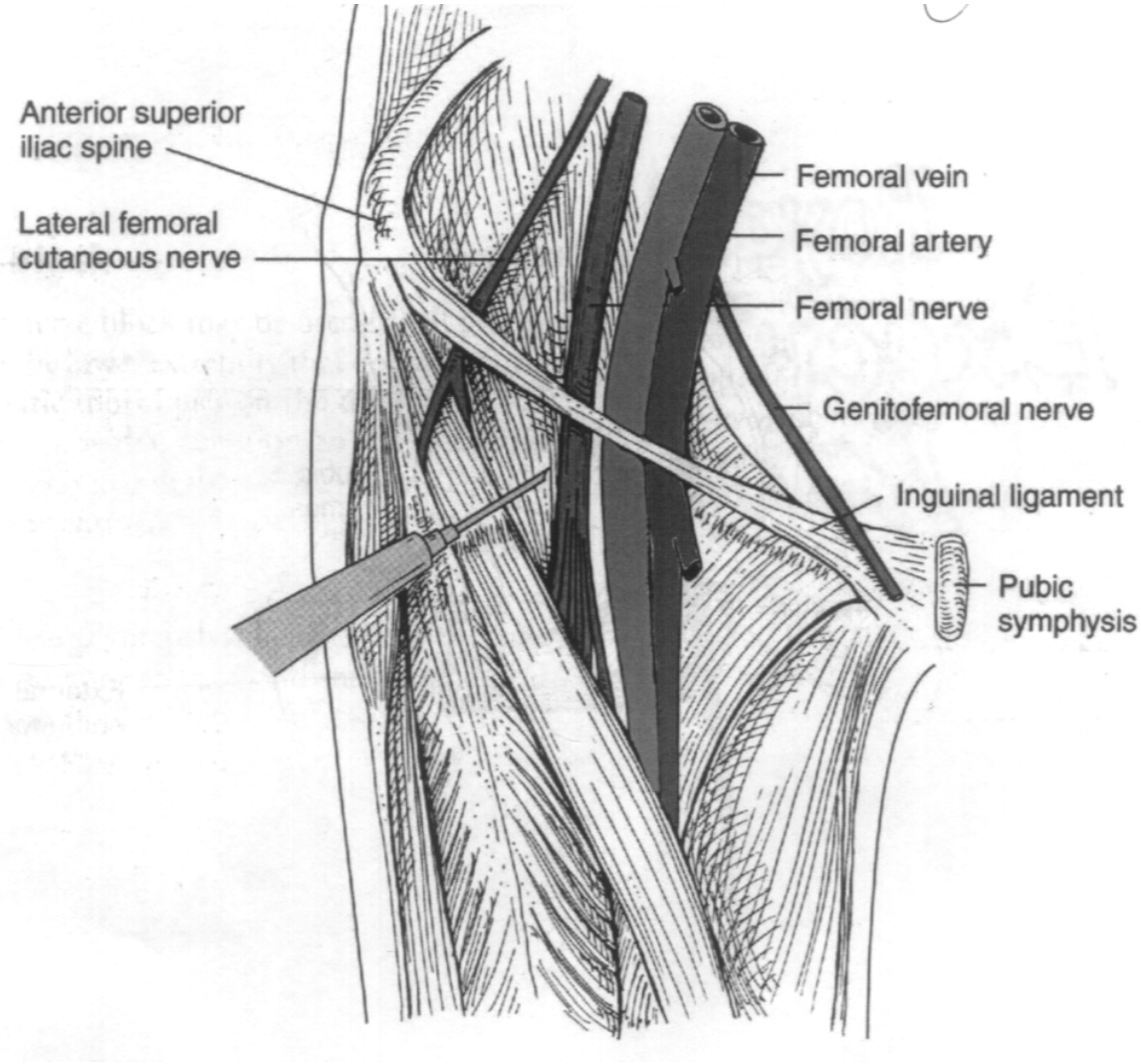
Anterior superior Iliac spine, pubic tubercle and femoral artery were identified.

Inguinal ligament

Line drawn between the anterior superior iliac spine and pubic tubercle.

Femoral artery located at the mid point of inguinal ligament, femoral nerve lies lateral to the artery.

THREE IN ONE FEMORAL NERVE BLOCK



Procedure

Conductive patches were attached on the ipsilateral thoracic wall and connected to the nerve locator.

The site of puncture for entry into the perineural space of the femoral nerve is located approximately 1.5cm below the inguinal ligament and 1.5 cm lateral to the femoral artery. A 2 inch 22 gauge short bevelled Teflon – coated nerve locator needle with stimulator attached is advanced slowly at an angle of 45^{o} to skin, parallel to the femoral artery in a cranio – dorsal direction. Once the needle is through the skin the nerve stimulation output is adjusted to 1-2 mA with a frequency of 1.0Hz.

A motor evoked response of movement of patella indicates stimulation of femoral nerve. Once the nerve is located, the needle position is optimized and the stimulus intensity is reduced until a patellar twitch is present at an output of 0.4 – 0.6 mA. Upto this point three in one nerve and femoral nerve block are the same. After negative aspiration for blood, a volume of 0.5ml / kg upto a maximum of 30 ml of 0.25% bupivacaine was given with distal pressure to push the local anaesthetic upwards. With this volume, the local anaesthetic tracks along the fascial sheath to block the lumbar plexus. i.e., the obturator, the lateral femoral cutaneous and the femoral nerve.

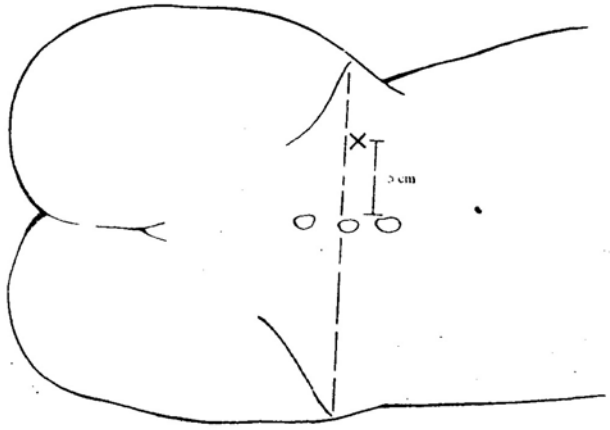
Psoas Compartment Block

Anatomy. At the level of lumbar segments four and five (L4-5), the nerves of the lumbar plexus lie in a fascial sheath between the psoas and the quadratus lumborum muscles. Anesthetic injected into the sheath will bathe the three main nerves and possibly the sciatic nerve (Brown, 1992)[5].

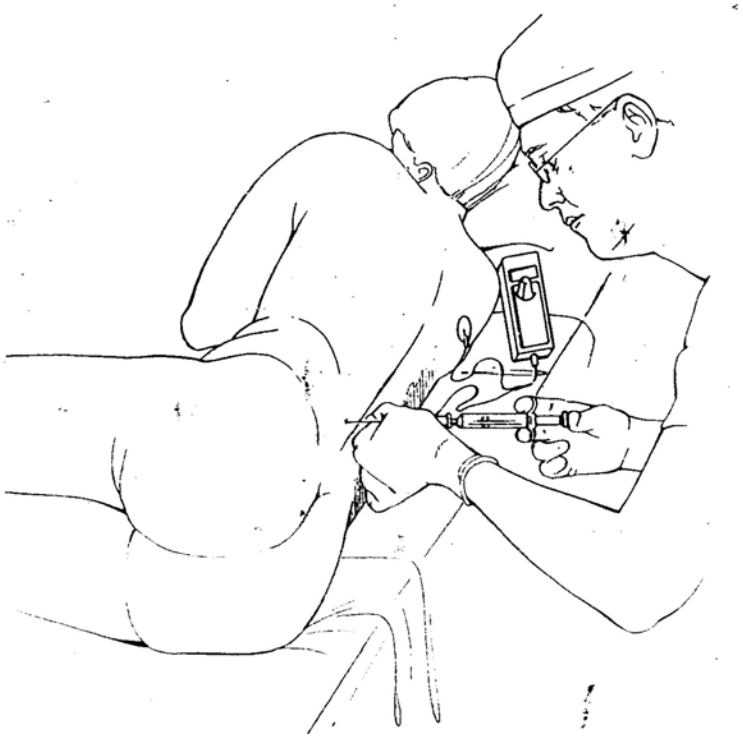
Technique. Patients were placed in the lateral decubitus position with the side to be blocked uppermost. The skin over the area to be injected was prepared with antiseptic solution. A line was drawn between the iliac crests and midpoint at the fourth lumbar spine was marked. A second line was drawn five centimeters parasagitally to the midline. This identifies the injection site, at the intersection point of these two lines.

A 22-gauge, four-inch Teflon coated needle was inserted. The transverse process of the lumbar fifth vertebrae was located with the needle. The needle was then slightly withdrawn and redirected cephalad until it slips past the transverse process. Now the nerve locator is set to deliver a current of 2mA at 1 Hertz frequency. Needle is advanced until lumbar plexus is located. Once the lumbar plexus is located, the twitch strength is decreased to 0.4 – 0.6 mA while adjusting the needle to maintain quadriceps contraction. The needle was then held in place and after negative aspiration for blood 0.25% bupivacaine 0.5ml/kg to the maximum of 30ml was injected with aspiration attempted after each five milliliters. The lateral femoral cutaneous nerve innervates the skin of

SURFACE MARKING FOR PSOAS COMPARTMENT BLOCK



PERFORMING PSOAS COMPARTMENT BLOCK USING NERVE LOCATOR



the lateral aspect of the thigh, the obturator nerve innervates the medial aspect of the thigh and the femoral nerve innervates the anteromedial aspect of thigh progressing to the medial aspect of the lower leg.

Evaluation

Both the groups were evaluated for

1. Time for performing the block (from the needle entry to completion of injection)
2. Time for onset of block (by loss of cold sensation)

After completion of blocks, patients were placed in supine and checked for loss of cold sensation using spirit in a cotton, every 30 seconds. Lack of sensation for cold is taken as the time for onset of block.

After evaluating the onset time, both groups were given general anaesthesia with controlled ventilation. Drugs used were thiopentone sodium, succinyl choline, fentanyl, non-depolarising muscle relaxant, rocuronium.

Inj. Fentanyl – 1 μg/kg is given during induction, followed by intermittent incremental dose of 0.5μg/kg. The supplementation of fentanyl was not less than 45 min before the completion of surgery.

After completion of surgery, patients were reversed with neostigmine and glycopyrollate and extubated after adequate recovery. They evaluated for pain using 4 point verbal rating scale. (Choeng et al 2001)[14]

0 - no pain

1 - mild pain

2 - moderate pain

3 - severe pain

They were assessed at 0 hour (Immediately after extubation), at 6 hours and time of onset of severe pain noted.

If the patients have a pain score of 3 at 0 hour considered as block failure and excluded from study.

If the VRS score is equal to 2, they will receive a dose of Diclofenac sodium.

VRS > 2 will receive opoids (Pentazocine / Promethazine) and the time noted.

Local anaesthetic toxic reactions including subjective and objective manifestations like circumoral numbness, tinnitess, twitching, convulsion etc., if any were looked for and appropriate measure were planned.

Any other complications like hematoma (or) bleeding were noted.

Parameters studied

1. Time for performing the block :

Time from point of needle entry to the removal of needle after injecting local anaesthetic.

2. Onset of sensory analgesia

This is the time in minutes (or) seconds from the injection of the drug to the lack of appreciation of cold sensation.

3. Duration of post operative analgesia

From extubation to onset of severe pain.

OBSERVATION AND RESULTS

The patients included in the study were divided into two groups consists of 25 patients each.

Group I : Three in one nerve block

Group II : Psoas compartment block

Test Statistics

1. Chi – Square test
2. Two sample t test

TABLE 1: AGE DISTRIBUTION

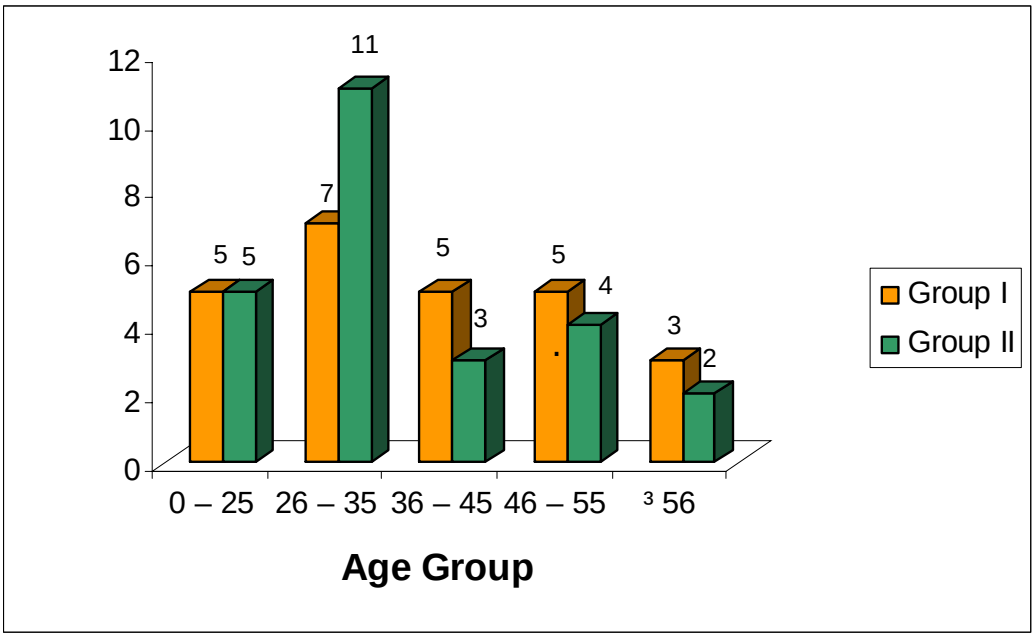
Age group	Group I	Group II
0 – 25	5	5
26 – 35	7	11
36 – 45	5	3
46 – 55	5	4
≥ 56	3	2
	25	25

Age	Mean ± S.E. of Mean
Group I	38.08 ± 2.663281
Group II	35.28 ± 2.755915

P. Value = 0.468580 – Not significant

(P < 0.05 is significant)

DISTRIBUTION OF AGE GROUP



DISTRIBUTION OF SEX

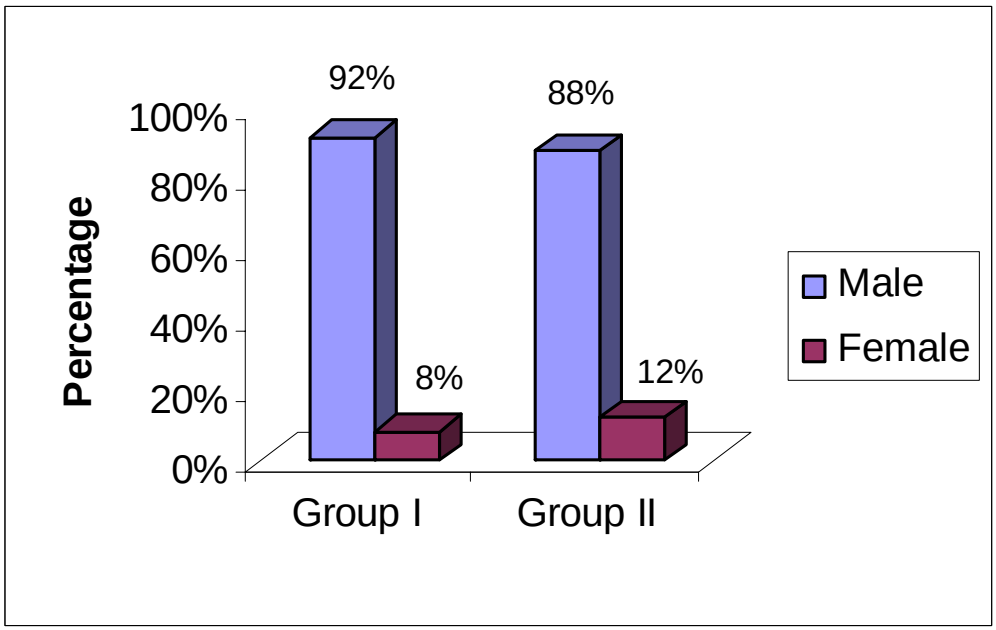


Table 2 :DISTRIBUTION OF SEX

Sex	Group I	%	Group II	%	Total
Male 1	23	92%	22	88%	45
Female 2	2	8%	3	12%	5
	25	100%	25	100%	50

P value = 0.6374 – Not significant

TABLE 3 : DISTRIBUTION OF HEIGHT

Height	Mean ± S.E. of Mean
Group I	167.52 ± 1.213974
Group II	166.88 ± 1.23061

P value = 0.712835 - Not Significant

TABLE 4 : DISTRIBUTION OF WEIGHT

Weight	Mean ± S.E. of Mean
Group I	62.44 ± 1.397712
Group II	62.52 ± 1.297588

P value = 0.966715 - Not Significant

TABLE 5: DISTRIBUTION OF BODY MASS INDEX

BMI	Mean ± S.E. of Mean
Group I	22.28 ± 1.773276
Group II	22.4316 ± 2.117317

P value = 0.0791001- Not Significant

TABLE 6: DISTRIBUTION OF TYPE OF INJURY

Pathology Code	Group I		Group II		Total
	No. of Patients	Percentage	No. of Patients	Percentage	
1	17	68%	17	68%	34
2	5	20%	3	12%	8
3	1	4%	2	8%	3
4	2	8%	3	12%	5
	25	100%	25	100%	50

P value = 0.793187 – Not significant

Pathology Code :

1 – Fracture Shaft of Femur, 2 – Supracondylar Fracture Femur,
3 – Trochantric Fracture Femur, 4 – Fracture Neck of Femur

TABLE 7: DISTRIBUTION OF SURGICAL PROCEDURE

Procedure Code	Group I		Group II		Total
	No. of Patients	Percentage	No. of Patients	Percentage	
1	9	36%	11	44%	20
2	4	16%	4	16%	8
3	3	12%	3	12%	6
4	7	28%	4	16%	11
5	2	8%	3	12%	5
	25	100%	25	100%	50

P value = 0.8751 – Not significant

Procedure Code

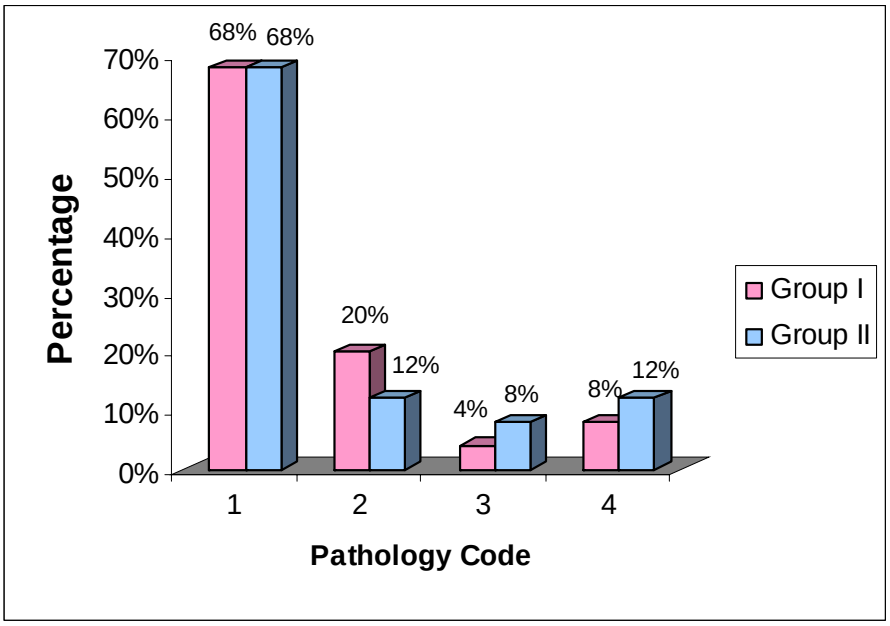
1 – Interlocking Nail, 2 – Intramedullary Nail, 3 – Plate and Screws
4 – Dynamic Compression Screws, 5 – Hemiarthroplasty

TABLE 8: DISTRIBUTION OF TIME FOR SURGICAL PROCEDURE (MINS)

Time	Mean ± S.E. of Mean
Group I	144.2 ± 3.325157
Group II	144.2 ± 3.453018

P value = 0.0678385 - Not Significant

DISTRIBUTION OF TYPES OF INJURIES



DISTRIBUTION OF SURGICAL PROCEDURE

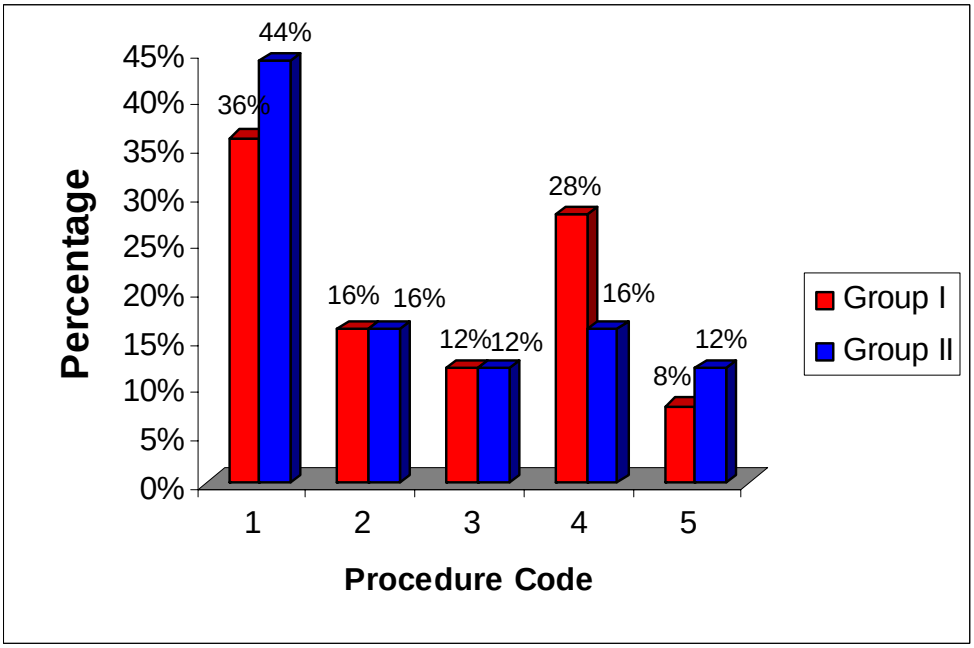


TABLE 9: DISTRIBUTION OF TIME FOR NERVE BLOCK (SECS)

Time	Mean ± S.E. of Mean
Group I	327.2 ± 7.773245
Group II	333.8 ± 11.04264

P value = 0.627254 - Not Significant

TABLE 10: ONSET OF ACTION (SECS)

Onset of Action	Mean ± S.E. of Mean
Group I	292.8 ± 7.2
Group II	292.8 ± 6.9885

P value = 0.000 - Not Significant

TABLE 11: PAIN SCORE AT 6 HOURS

Pain score	Group I	Group II	Total
0	15	18	33
1	8	7	15
2	2	0	2
Total	25	25	50

P value = 0.3704546 - Not Significant

PAIN SCORE AT 6 HOURS

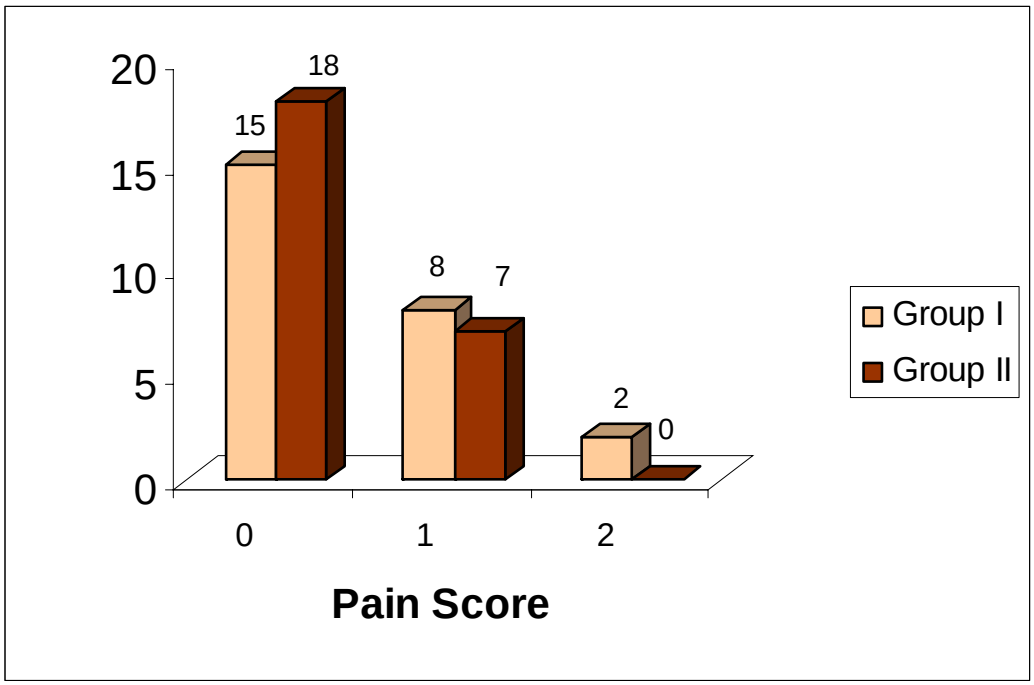


TABLE 12: DURATION OF PAIN RELIEF FOR DIFFERENT PROCEURES

Procedure	Group	No. of Cases	Mean	Standard Error of Mean	P value
DCS	I	7	567.857	± 14.051	P = 0.179826 Not significant
	II	4	612.5	± 27.5	
Hemi arthroplast	I	2	585	± 15	P = 0.24989 Not significant
	II	3	630	± 22.91	
IM Nailing	I	4	556.25	± 14.63087	P = 0.041390 Significant
	II	4	631.25	± 25.03123	
IL Nail	I	9	559.4445	± 20.940	P = 0.101094 Not significant
	II	11	609.5455	± 19.8454	
Plate	I	3	553.333	± 30.867	P = 0.293613 Not significant
	II	3	631.666	± 57.03313	

TABLE 13: DURATION OF PAIN RELIEF (MINS)

Duration	Mean ± S.E. of Mean
Group I	562.6 ± 9.1566
Group II	618.6± 11.9147

P value = 0.000511 - Significant

DISCUSSION

It is well known that orthopaedic procedures have high incidence of severe post operative pain and require adequate post operative analgesia[11].

The purpose of this study was to describe post operative pain relief associated with two different regional anaesthetic techniques of blocking the nerves of the lumbar plexus in patients undergoing orthopedic procedures on femur.

The mean time for the performance of block on Group I (3 in 1 block) – 327.2 sec

The mean time for the performance of block on Group – II is 333.8 sec. (P value = 0.627254 – not significant , Table No.9)

Mean time for the onset of block (assessed by loss of cold sensation)

In Group I - 292.8 sec

Group II - 292.8 sec

(P value = 0.000, Table No.10)

Statistically not significant

In this study the post operative analgesia (i.e. the time from the need for (opiods) analgesic) is about 562.6 minutes (9.376 hours), for patient who receive a 3 in 1 block with general anaesthetia undergoing surgery on femur.

In group II patients who receive psoas compartment block with general anesthesia, the mean duration of pain relief is 618.6 min (10.31 hours).

The concept of pre-emptive analgesia implies that postoperative pain can be reduced if the nerve – transmission is blocked prophylactically, before the stimulus is presented. By using a regional technique, the pain signal is pre-empted in the neural circuit. The signal is never transmitted to the spinal cord and subsequently to the brain. The route of pain transmission and perception is never established. On the contrary, using general anaesthesia alone, the pain signal is transmitted, to be modified by other means.

In this study, on comparing the pain score at 0 hour, (immediately after extubation) in Group I no one felt pain. At six hours after extubation 8 patients had pain score of 1 and 2 patients had pain score of 2. But none had a pain score of > 2. Likewise in Group II 7 patients had pain of 1 and none had a pain score of 2 at 6 hours post operatively (P value = 0.37045 – not significant, Table No.11).

Low rate of analgesic requirements is consistent with earlier studies comparing patient controlled analgesia and lumbar plexus block for Anterior Cruciate Ligament reconstruction.

Matheney et al (1993)[24] demonstrated that the average total dose of narcotic used for patients undergoing Anterior Cruciate Ligament reconstruction in the lumbar plexus blockade group was 10.1mg compared to the 91.9mg for the patient controlled analgesia group. This is beneficial to the patient as high dose of narcotic is frequently associated with side effects such as nausea, urinary retention, sedation and pruritis.

In this study only 8% Group I and 4% of Group II patients required analgesic within 6 hours (Diclofenac Sodium). Regional nerve blockade for knee surgery have been demonstrated to be consistently beneficial in controlling pain (Fournier et al, 1998)[17]. A common misconception is that they take too long to perform and can delay surgery.

Interestingly, the average time to perform 3 in 1 block is 327.2/60 sec (i.e) 5 min and 27 sec and psoas compartment block is 338 sec (i.e.) 5 min and 33 sec

If properly planned this amount of time should not delay the surgery, especially if the regional technique is combined with general anaesthesia. The nerve blockade should be evaluated before the induction of general anaesthesia, however it is not necessary for the blockade to completely take effect before surgery is begun. Complete blockade of the nerves will occur prior to the end of surgery, when it is necessary for control of post operative pain (Fournier et al 1998)[17] (Captain Cheryl A Burch – 1999)[13].

In this study, the length of time to administer the regional technique was short, which will encourage the use these procedures for post operative analgesia. Patients could arrive 15 – 20 minutes earlier than normally scheduled in anticipation of block administration.

In this study, we have included patients undergoing orthopaedic procedures on femur. Though the surgical procedure varies, duration of surgery does not differ grossly. We have included five different procedures on femur, in this study.

The number of cases included in each group is comparable and there is no statistical difference between the groups.

We also compared the pain relief achieved by the two techniques for each orthopaedic procedure. Average duration of post operative pain relief is definitely longer in group II patients compared to group I patients (Table No.12 and 13).

SUMMARY

On comparing ‘3 in 1’ nerve block with posas compartmental block using 0.25% bupivacaine for post operative analegesia, in orthopaedic procedures on femur;

1. Time for performing the block is short and comparable in both techniques.
2. Onset of block is also short and comparable (using loss of cold sensation as end point) in both techniques.
3. Duration of time from the end of surgery to onset of severe pain is longer in group II patients (Psoas compartment group) than group I patients (3 in 1 group).

CONCLUSION

Both the techniques (single shot 3 in 1 block or psoas compartment block) can be employed with general anaesthesia for post operative analgesia in orthopaedic procedures on femur.

Psoas compartment block with general anaesthesia is better than 3 in 1 block for post operative analgesia for orthopaedic procedures on femur.

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PROTOCOL

TOPIC

Comparison of duration of post operative analgesia between three in one nerve block versus psoas compartment block using 0.25% bupivacaine.

OBJECTIVE :

To compare the time for performing the block, onset of block (by loss of cold sensation) and duration of post operative analegesia using 0.25% bupivacaine between the two techniques in orthopaedic procedure in femur.

PROCEDURE :

Type of patient	:	ASA I / II
Type of surgery	:	Lower limb orthopaedic procedure on femur
Anaesthesia	:	General Anaesthesia combined with three in one nerve block (or) psoas compartment block
Dose for nerve block	:	0.25% bupivacaine 0.5ml / kg to a maximum of 30 ml
Monitors	:	ECG, SPO_2, NIBP, pulse rate, urine output

PARAMETERS OBSERVED

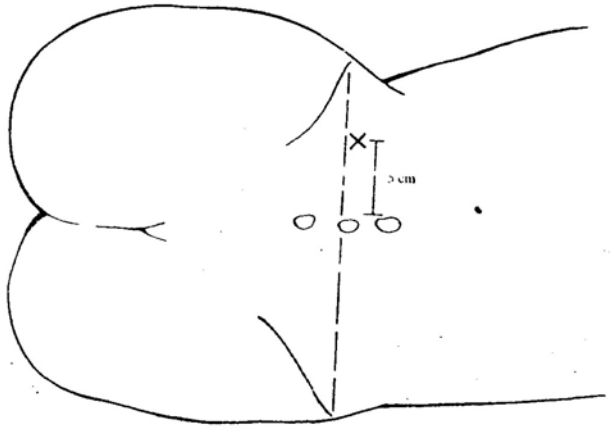
1. Time for performing the block
2. Onset of sensory blockade
3. Pain score at 0 hours – Immediately after completion of surgery

   6 hours – from the end of surgery
4. Duration of pain relief after completion of surgery (Pain score ≤ 2)

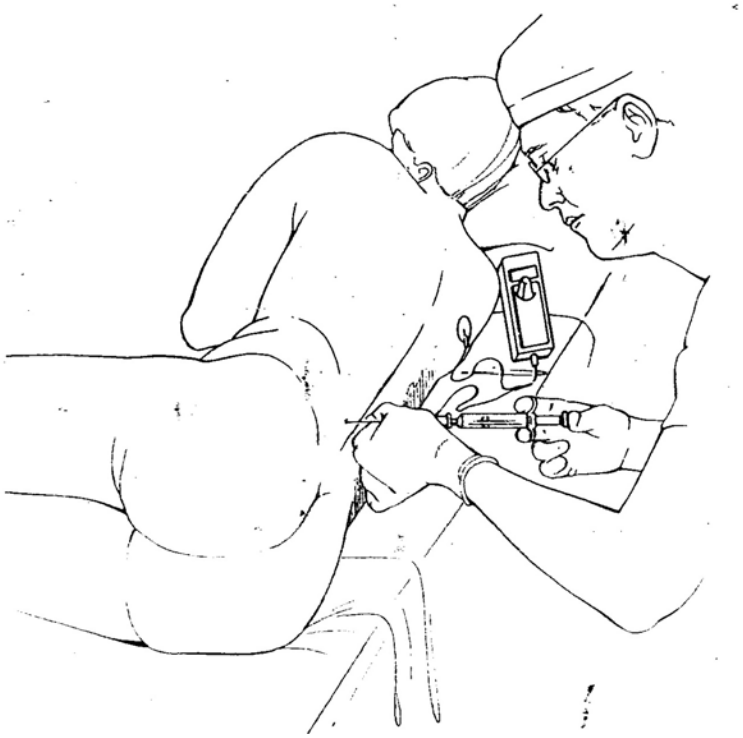
EXCLUSION CRITERIA

7. History of allergy to local anaesthetics
8. Bleeding diathesis
9. Neurological disorders
10. Local sepsis
11. Patient refusal
12. Technical failure

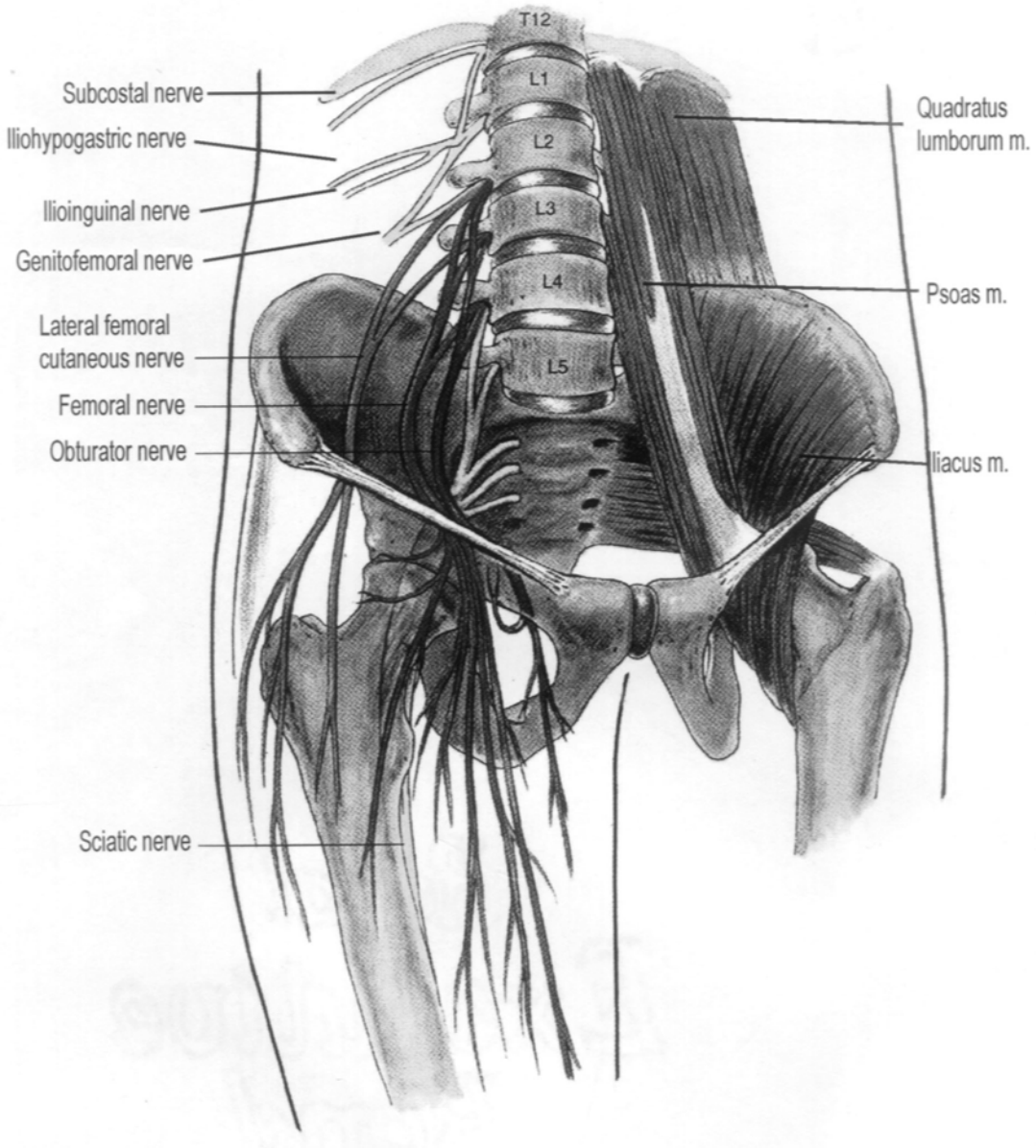
SURFACE MARKING FOR PSOAS COMPARTMENT BLOCK



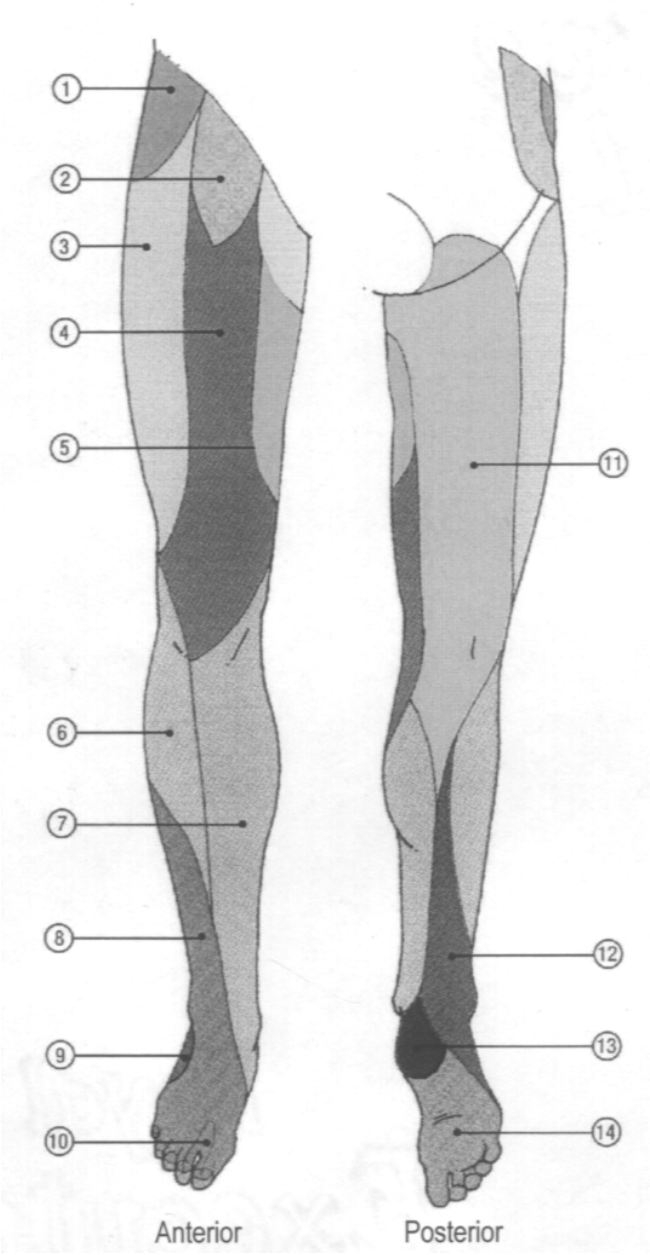
PERFORMING PSOAS COMPARTMENT BLOCK USING NERVE LOCATOR



LUMBAR AND LUMBOSACRAL PLEXUS : FORMATION

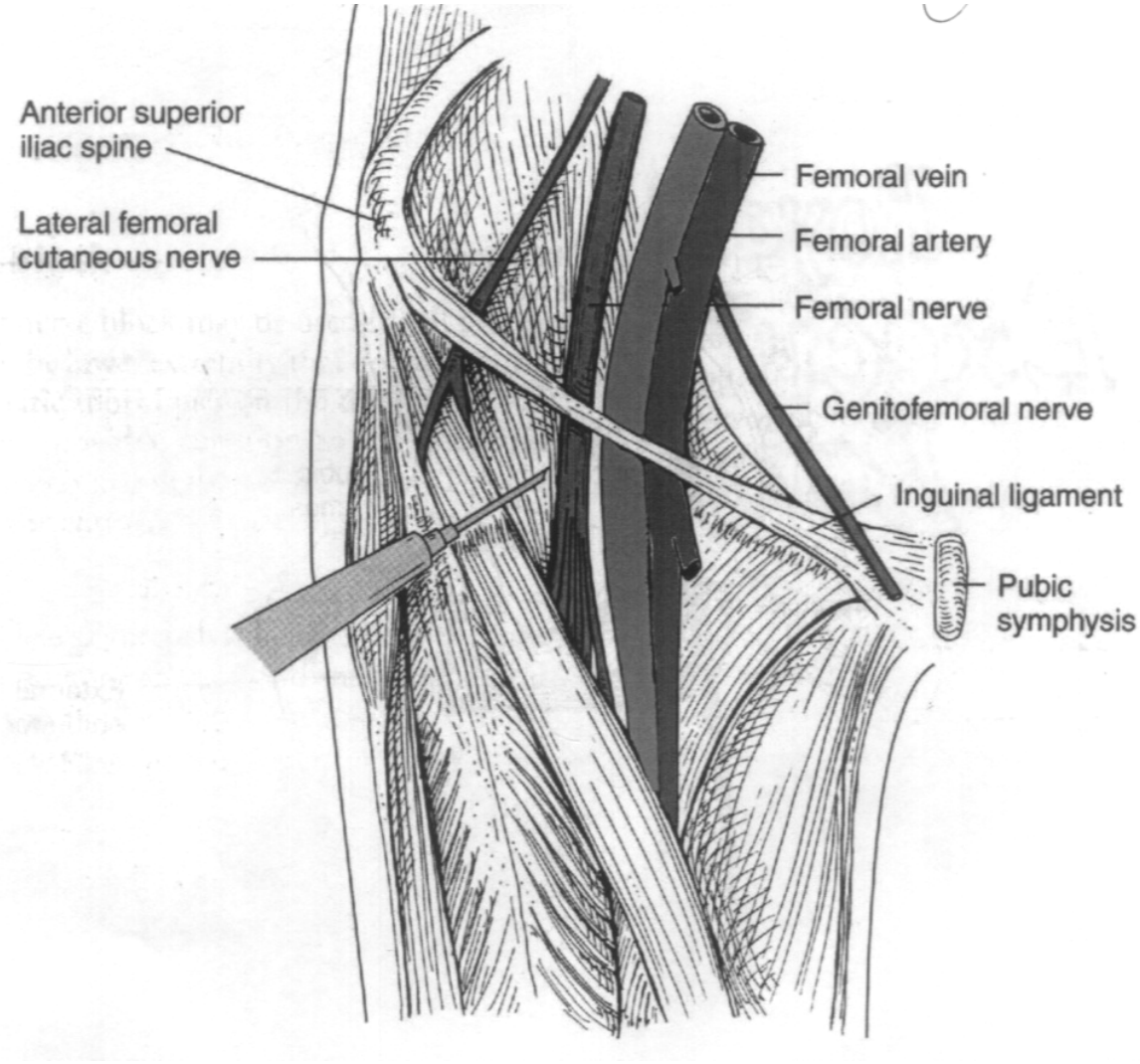


CUTANEOUS INNERVATION OF THE LOWER LIMB



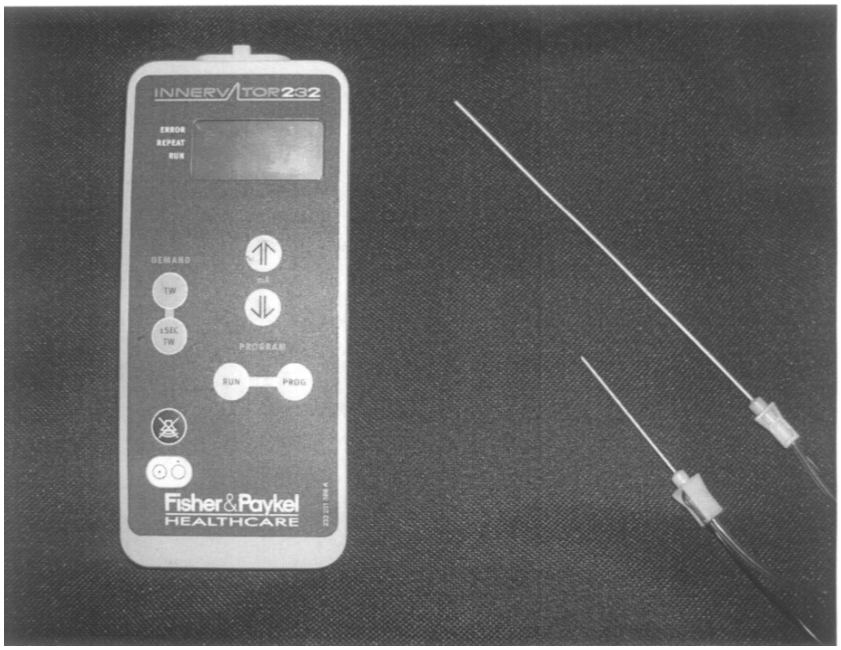
15. Lateral cutaneous branch of subcostal nerve
16. Femoral branch of genitofemoral nerve
17. Lateral femoral cutaneous nerve
18. Anterior femoral cutaneous nerve
19. Obturator nerve
20. Common peroneal nerve
21. Saphenous nerve
22. Superficial peroneal nerve
23. Sural nerve
24. Deep peroneal nerve
25. Posterior cutaneous nerve of thigh
26. Sural nerve
27. Calcaneal branch of tibial nerve
28. Plantar branches of tibial nerve

THREE IN ONE FEMORAL NERVE BLOCK



BUPIVACAINE

NERVE LOCATOR & NERVE LOCATOR NEEDLES



Master Chart
Group I (3 in 1 nerve block)

Sl No.	Name	Group	age	sex	Ht. (cm)	Wt. (kgs)	BMI	pathology	code	Procedure	Pro-code	Duration (min)	Time for NB (sec)	on set of analge (sec)	pain 0 hr	pain 6 hrs	on set severe pain
1	Rajendiran	1	42	1	169	55	19.25	shaft of femur fracture -l	1	plate & screws	3	150	270	300	0	1	520
2	Govindaraj	1	50	1	166	60	21.77	shaft of femur fracture-R	1	interlocking nail	1	140	300	330	0	0	550
3	Jayavel	1	28	1	171	66	22.57	shaft of femur fracture -l	1	IM nail	2	140	300	240	0	0	590
4	Nirosha	1	17	2	155	48	19.97	shaft of femur fracture -l	1	plate & screws	3	100	360	300	0	0	615
5	kalidoss	1	34	1	164	56	20.82	shaft of femur fracture-R	1	IM nail	2	125	360	300	0	1	525
6	Burendra	1	24	1	170	58	20.06	shaft of femur fracture -l	1	DCS	4	145	360	240	0	1	495
7	Prakash	1	32	1	176	73	23.56	supracandylar fra-femur-R	2	DCS	4	125	330	300	0	0	600
8	Muthal	1	50	1	162	60	22.86	shaft of femur fracture -l	1	interlocking nail	1	150	270	240	0	0	630
9	Muthaiah	1	50	1	156	56	23	shaft of femur fracture -l	1	interlocking nail	1	160	330	300	0	1	525
10	Suryashankar	1	27	1	172	66	22.3	shaft of femur fracture-R	1	plate & screws	3	155	330	360	0	1	525
11	Moorthy	1	40	1	161	52	20.06	supracandylar fra-femur-l	2	DCS	4	160	270	240	0	0	600
12	Paranjothi	1	57	2	159	55	21.75	shaft of femur fracture -l	1	interlocking nail	1	150	300	270	0	0	690
13	Kuppan	1	48	1	170	66	22.8	shaft of femur fracture-R	1	interlocking nail	1	130	360	300	0	2	510
14	Dhanasekar	1	22	1	171	56	19.15	supracandylar fra-femur-l	2	DCS	4	160	320	270	0	0	585
15	Bharanidharan	1	52	1	173	63	21	Neck of femur fracture-L	4	Hemiarthroplasty	5	120	300	240	0	0	600
16	Anand	1	23	1	166	60	21.77	shaft of femur fracture-R	1	interlocking nail	1	150	310	270	0	2	495
17	Ramaswamy	1	65	1	172	68	22.98	Neck of femur fracture-L	4	Hemiarthroplasty	5	130	375	330	0	0	570
18	Mohan	1	60	1	168	61	21.6	Trochantric fracture-R	3	DCS	4	165	275	300	0	0	585
19	Janakiraman	1	42	1	167	66	23.6	shaft of femur fracture -l	1	interlocking nail	1	130	320	330	0	1	540
20	Narasimhan	1	35	1	170	71	24.56	shaft of femur fracture-R	1	interlocking nail	1	160	400	300	0	0	570
21	Karthik	1	22	1	176	63	23.38	supracandylar fra-femur-R	2	DCS	4	155	330	270	0	0	555
22	Maharoof basha	1	36	1	175	75	23.5	shaft of femur fracture -l	1	IM nail	2	165	380	300	0	0	540
23	Balamurugan	1	27	1	159	66	26.1	shaft of femur fracture-R	1	interlocking nail	1	150	320	330	0	1	525
24	Baskar	1	42	1	166	68	24.6	supracandylar fra-femur-R	2	DCS	4	160	310	360	0	1	555
25	Shivashankar	1	27	1	174	73	24.1	shaft of femur fracture-R	1	IM nail	2	130	400	300	0	0	570

Master Chart
Group II (Psoas Compartment Block)

Sl No.	Name	Group	age	sex	Ht. (cm)	Wt. (kgs)	BMI	pathology	code	Procedure	Pro-code	Duration (min)	Time for NB (sec)	on set of analge (sec)	pain 0 hr	pain 6 hrs	on set severe pain
26	Jyothi	2	54	1	166	55	19.95	supracandylar fra-femur-l	2	DCS	4	140	300	300	0	0	600
27	Vijayalakshmi	2	18	2	156	48	19.72	shaft of femur fracture-R	1	plate & screws	3	120	270	300	0	0	720
28	Murugan	2	26	1	170	66	22.8	shaft of femur fracture-R	1	interlocking nail	1	175	240	360	0	1	570
29	Karthikeyan	2	28	1	168	68	24.1	shaft of femur fracture -l	1	plate & screws	3	140	360	360	0	0	650
30	Emrose	2	34	1	163	65	24.4	shaft of femur fracture-R	1	IM nail	2	125	420	300	0	0	570
31	Bodhraj	2	26	1	171	69	23.5	shaft of femur fracture-R	1	interlocking nail	1	140	420	300	0	0	735
32	Gopi	2	35	1	160	55	21.48	Trochantric fracture-L	3	DCS	4	120	360	300	0	0	650
33	John	2	29	1	169	58	20.3	shaft of femur fracture-R	1	interlocking nail	1	160	290	270	0	0	590
34	Karthick	2	21	1	175	75	24.48	supracandylar fra-femur-R	2	interlocking nail	1	130	360	240	0	1	530
35	Adhimoolam	2	50	1	168	55	19.48	neck of femur fracture-R	4	Hemiarthroplasty	5	125	300	240	0	1	585
36	Raghu	2	26	1	172	62	20.9	shaft of femur fracture -l	1	IM nail	2	150	350	270	0	0	620
37	Sarasu	2	58	2	160	58	22.6	Trochantric fracture-L	3	DCS	4	160	360	300	0	0	660
38	Pappammal	2	66	2	158	58	23.2	neck of femur fracture-R	4	Hemiarthroplasty	5	130	400	330	0	0	645
39	Jagadeesan	2	16	1	166	60	21.7	shaft of femur fracture-R	1	interlocking nail	1	155	380	300	0	0	690
40	Chandran	2	52	1	169	64	22.4	neck of femur fracture-R	4	Hemiarthroplasty	5	110	330	270	0	0	660
41	Shankar	2	26	1	176	70	22.5	shaft of femur fracture -l	1	interlocking nail	1	160	375	330	0	1	585
42	Narasimhan	2	45	1	163	65	24.46	shaft of femur fracture-l	1	interlocking nail	1	150	300	240	0	0	615
43	Karthick	2	18	1	169	54	18.9	supracandylar fra-femur-R	2	DCS	4	170	270	240	0	1	540
44	Venkatesan	2	29	1	156	62	25.47	shaft of femur fracture-R	1	IM nail	2	130	310	270	0	0	645
45	Narayanasamy	2	55	1	158	67	26.8	shaft of femur fracture-l	1	interlocking nail	1	150	400	330	0	1	530
46	Kumaravel	2	38	1	174	72	23.78	shaft of femur fracture-R	1	plate & screws	3	125	410	300	0	1	525
47	Annadurai	2	37	1	172	60	20.28	shaft of femur fracture-R	1	interlocking nail	1	140	330	330	0	0	570
48	Bhakthavatchalar	2	35	1	170	65	22.49	shaft of femur fracture-l	1	interlocking nail	1	165	270	300	0	0	675
49	Babu	2	35	1	167	70	25.09	shaft of femur fracture-l	1	IM nail	2	135	240	270	0	0	690
50	Saravanan	2	25	1	176	62	20.01	shaft of femur fracture-l	1	interlocking nail	1	150	300	270	0	0	615